ResearchGate

See discussions, stats, and author profiles for this publication at: https://www.researchgate.net/publication/326841445

Artificial General Intelligence

Book · August 2018

DOI: 10.1007/978-3-319-97676-1

CITATIONS
0

READS
759

4 authors, including:

Matthew Ikle
Adams State University
36 PUBLICATIONS **73** CITATIONS
SEE PROFILE

Arthur Franz
Odessa Competence Center for Artificial intelligence and Machine learning (OCCAM)
10 PUBLICATIONS **43** CITATIONS
SEE PROFILE

Rafal Rzepka
Hokkaido University
256 PUBLICATIONS **808** CITATIONS
SEE PROFILE

Some of the authors of this publication are also working on these related projects:

Project Figurative Language Processing and Generation (Poetry, Humor and Metaphors) View project

Project Toward tractable universal induction View project

All content following this page was uploaded by Rafal Rzepka on 06 August 2018.

The user has requested enhancement of the downloaded file.

Lecture Notes in Artificial Intelligence 10999

Subseries of Lecture Notes in Computer Science

LNAI Series Editors

Randy Goebel
University of Alberta, Edmonton, Canada
Yuzuru Tanaka
Hokkaido University, Sapporo, Japan
Wolfgang Wahlster
DFKI and Saarland University, Saarbrücken, Germany

LNAI Founding Series Editor

Joerg Siekmann
DFKI and Saarland University, Saarbrücken, Germany

More information about this series at http://www.springer.com/series/1244

Matthew Iklé · Arthur Franz
Rafal Rzepka · Ben Goertzel (Eds.)

Artificial General Intelligence

11th International Conference, AGI 2018
Prague, Czech Republic, August 22–25, 2018
Proceedings

Springer

Editors
Matthew Iklé
Adams State University
Alamosa, CO
USA

Arthur Franz
Odessa Competence Center
for Artificial Intelligence (OCCAM)
Odessa
Ukraine

Rafal Rzepka
Hokkaido University
Sapporo
Japan

Ben Goertzel
SingularityNET; OpenCog; Hanson
Robotics
Hong Kong
China

ISSN 0302-9743 ISSN 1611-3349 (electronic)
Lecture Notes in Artificial Intelligence
ISBN 978-3-319-97675-4 ISBN 978-3-319-97676-1 (eBook)
https://doi.org/10.1007/978-3-319-97676-1

Library of Congress Control Number: 2018950096

LNCS Sublibrary: SL7 – Artificial Intelligence

© Springer Nature Switzerland AG 2018
This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.
The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.
The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, express or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer Nature Switzerland AG
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

Preface

The year 2018 could be considered the year artificial general intelligence (AGI) became mainstream. Since Apple's Siri was first introduced in 2011, narrow AI technologies have permeated increasingly more aspects of our everyday lives. AI systems such as Google's Assistant, Amazon's Alexa, Microsoft's Cortana, iPhone X's face-recognition software, self-driving vehicles, and IBM Watson's text-reading AI for medical research are just a few examples of how AI systems are changing how we live and work on a daily basis.

As these narrow AI systems become increasing prevalent, attention has begun to shift toward the next generation of AI research including AGI. MIT introduced an online graduate course in AGI in 2018, magazines such as *Forbes* have published articles about the potential future of general AI systems, and the Discovery Channel included a segment about AGI in its program "This Is AI." The humanoid robot, Sophia, became the first robot citizen in 2017, and SingularityNET, founded in 2017, began the process of integrating AGI with blockchain technology. These are indeed exciting times.

Despite all the current enthusiasm in AI, the technologies involved still represent no more than advanced versions of classic statistics and machine learning. Behind the scenes, however, many breakthroughs are happening on multiple fronts: in unsupervised language and grammar learning, deep-learning, generative adversarial methods, vision systems, reinforcement learning, transfer learning, probabilistic programming, blockchain integration, causal networks, and many more.

The 11th AGI conference took place in Prague, Czech Republic, during August 22–25, 2018. For the second time, the AGI conference was held as part of the larger Joint Multi-Conference on Human-Level Intelligence, HLAI, which co-located AGI 2018 with BICA 2018 (the Annual International Conferences on Biologically Inspired Cognitive Architectures), and NeSy 2018 (the Workshop Series on Neural-Symbolic Learning and Reasoning). Also included as part of HLAI 2018 was a separate day-long track, following the main sessions, discussing "The Future of AI."

This volume contains the contributed talks presented at AGI 2018. Of the 52 papers submitted to the conference and reviewed by two or more Program Committee members, 19 long papers papers were accepted (37% acceptance) for oral presentation, and ten papers were accepted for poster presentations. One hallmark of the AGI conference series has always been the incredible diversity of ideas on display through its collection of contributed papers, and this year continued that trend. There are papers covering AGI architectures, papers discussing mathematical and philosophical foundations and details, papers developing ideas from neuroscience and cognitive science, papers on emotional modeling, papers discussing ethical strategies, and a host of other papers covering a wide-ranging array of additional relevant topics.

Keynote speeches were shared by the participating organizations and included speeches by Ben Goertzel (SingularityNET, and Hanson Robotics), Thomas Parr

(University College London), Tomas Mikolov (Facebook AI Research), Paul Smolensky, (Microsoft), Dileep George, (Vicarious Systems), Dr. Vladimir G. Red'ko (Russian Academy of Sciences), and Hava Siegelmann (DARPA). Josef Urban delivered an additional AGI keynote on the topic "No One Shall Drive Us from the Semantic AI Paradise of Computer-Understandable Math and Science."

In addition, the AGI 2018 conference featured a "Tutorial on Comparing Intrinsic Motivations in a Unified Framework"; workshops on "AI4Space, AI for Space Exploration and Settlement," and "AI Meets Blockchain"; a symposium on "AI Safety and Societal Impacts"; a panel session covering "Machine Consciousness"; and a demonstration session.

We thank the people of GoodAI, in particular Olga Afanasjeva and Daria Hvizdalova, for all of their help planning and handling local organization; Tarek Beshold for having the vision for the larger Human Level AI conference series; and all the Program Committee members for their dedicated service to the review process. We thank all of our contributors, participants, and tutorial, workshop, and panel session organizers, without whom the conference would not exist.

Finally, we thank our sponsors: the Artificial General Intelligence Society, Springer Nature Publishing, SingularityNET, Hanson Robotics, and OpenCog Foundation.

June 2018

Matthew Iklé
Arthur Franz
Rafal Rzepka
Ben Goertzel

Organization

Program Committee

Hadi Afshar	Australian National University, Australia
Joscha Bach	Massachusetts Institute of Technology, USA
Tarek Richard Besold	City, University of London, UK
Jordi Bieger	Reykjavik University, Iceland
Cristiano Castelfranchi	Institute of Cognitive Sciences and Technologies, Italy
Antonio Chella	Università di Palermo, Italy
Arthur Franz	Odessa Competence Center for Artificial Intelligence and Machine Learning, Ukraine
Nil Geisweiller	OpenCog Foundation, SingularityNet Foundation, Novamente LLC, France
Ben Goertzel	SingularityNET; OpenCog; Hanson Robotics, China
Jose Hernandez-Orallo	Universitat Politècnica de València, Spain
Marcus Hutter	Australian National University, Australia
Matt Iklé	Adams State University, USA
Benjamin Johnston	University of Technology, Sydney, Australia
Garrett Katz	University of Maryland, USA
John Licato	Indiana University/Purdue University - Fort Wayne, USA
Sean Markan	Eudelic Systems LLC, USA
Amedeo Napoli	LORIA Nancy; CNRS, Inria, Université de Lorraine, France
Eric Nivel	CADIA, Reykjavik University, Iceland
Eray Ozkural	Bilkent University, Turkey
Maxim Peterson	ITMO University, Russia
Alexey Potapov	AIDEUS, Russia
Nico Potyka	Universität Osnabrück, Germany
Paul S. Rosenbloom	University of Southern California, USA
Rafal Rzepka	Hokkaido University, Japan
Oleg Scherbakov	ITMO University, Russia
Ute Schmid	University of Bamberg, Germany
Javier Snaider	Google, USA
Bas Steunebrink	IDSIA, Switzerland
Claes Strannegård	Chalmers University of Technology, Sweden
Kristinn R. Thorisson	CADIA, Reykjavik University, Iceland

Volkan Ustun	University of Southern California, USA
Mario Verdicchio	University of the West of Scotland, UK
Pei Wang	Temple University, USA
Roman Yampolskiy	University of Louisville, USA
Byoung-Tak Zhang	Seoul National University, South Korea

Additional Reviewer

Catt, Elliot

Contents

Hybrid Strategies Towards Safe "Self-Aware" Superintelligent Systems 1
Nadisha-Marie Aliman and Leon Kester

Request Confirmation Networks in MicroPsi 2 12
Joscha Bach and Katherine Gallagher

Task Analysis for Teaching Cumulative Learners 21
Jordi E. Bieger and Kristinn R. Thórisson

Associative Memory: An Spiking Neural Network Robotic Implementation 32
André Cyr, Frédéric Thériault, Matthew Ross, and Sylvain Chartier

A Comprehensive Ethical Framework for AI Entities: Foundations 42
Andrej Dameski

Partial Operator Induction with Beta Distributions 52
Nil Geisweiller

Solving Tree Problems with Category Theory 62
Rafik Hadfi

Goal-Directed Procedure Learning 77
Patrick Hammer and Tony Lofthouse

Can Machines Design? An Artificial General Intelligence Approach 87
Andreas M. Hein and Hélène Condat

Resource-Constrained Social Evidence Based Cognitive Model for Empathy-Driven Artificial Intelligence 100
Anton Kolonin

Unsupervised Language Learning in OpenCog 109
Alex Glushchenko, Andres Suarez, Anton Kolonin, Ben Goertzel, Claudia Castillo, Man Hin Leung, and Oleg Baskov

Functionalist Emotion Model in NARS 119
Xiang Li, Patrick Hammer, Pei Wang, and Hongling Xie

Towards a Sociological Conception of Artificial Intelligence 130
Jakub Mlynář, Hamed S. Alavi, Himanshu Verma, and Lorenzo Cantoni

Efficient Concept Formation in Large State Spaces 140
Fredrik Mäkeläinen, Hampus Torén, and Claes Strannegård

DSO Cognitive Architecture: Implementation and Validation of the Global Workspace Enhancement 151
Khin Hua Ng, Zhiyuan Du, and Gee Wah Ng

The Foundations of Deep Learning with a Path Towards General Intelligence. 162
Eray Özkural

Zeta Distribution and Transfer Learning Problem 174
Eray Özkural

Vision System for AGI: Problems and Directions 185
Alexey Potapov, Sergey Rodionov, Maxim Peterson, Oleg Scherbakov, Innokentii Zhdanov, and Nikolai Skorobogatko

Semantic Image Retrieval by Uniting Deep Neural Networks and Cognitive Architectures 196
Alexey Potapov, Innokentii Zhdanov, Oleg Scherbakov, Nikolai Skorobogatko, Hugo Latapie, and Enzo Fenoglio

The Temporal Singularity: Time-Accelerated Simulated Civilizations and Their Implications 207
Giacomo Spigler

A Computational Theory for Life-Long Learning of Semantics 217
Peter Sutor Jr., Douglas Summers-Stay, and Yiannis Aloimonos

Cumulative Learning with Causal-Relational Models 227
Kristinn R. Thórisson and Arthur Talbot

Transforming Kantian Aesthetic Principles into Qualitative Hermeneutics for Contemplative AGI Agents 238
Jeremy O. Turner and Steve DiPaola

Towards General Evaluation of Intelligent Systems: Using Semantic Analysis to Improve Environments in the AIQ Test. 248
Ondřej Vadinský

Perception from an AGI Perspective 259
Pei Wang and Patrick Hammer

A Phenomenologically Justifiable Simulation of Mental Modeling 270
Mark Wernsdorfer

A Time-Critical Simulation of Language Comprehension 281
Mark Wernsdorfer

How Failure Facilitates Success 292
Mark Wernsdorfer

Adaptive Compressed Search 303
Robert Wünsche

Author Index 311

View publication stats